

TAOBN: 1,4,4-Trimethyl-2,3-diazobicyclo-(3.2.2)-non-2-ene-2,3-dioxide.

INGREDIENT	AMOUNT (g)
Elvacite ® 2051	32.40
Vinac ® B-15	12.64
TMPTMA	35.55
TEOTA	7.90
o-Cl-HABI	1.58
2-Mercapto benzoxazole	0.71
Tinopal ® PCR	0.20
Tinopal ® SFG	0.99
Cyasorb ® UV-24	0.08
Brij ® 30	7.90
Hydroquinone	0.05
TAOBN	0.03

To support the disc during lamination, it is placed on a temporary carrier sheet of commercial color proofing receptor (Cromalin ® Masterproof Commercial Receptor, Product No. CM/CR, E. I. Du Pont de Nemours and Company, Inc., Wilmington, Del.). The dry film is laminated to the substrate using a Cromalin ® laminator (Du Pont, Wilmington, Del.) operating at a roll surface temperature of 115°-124° C. Lamination covers the disc surface uniformly and seals it around the edges to the carrier sheet; the disc is cut out with a razor blade and the laminated film cut away from the center hole.

Holographic relief information is transferred to the laminated disc by embossing the dry film layer with a nickel stamper carrying a surface relief corresponding to the holographic optical element. Holographic diffraction peaks/grooves on the stamper are approximately 0.1 to 3.5 microns and have an aspect ratio of about 20:1 (Aspect ratio is the ratio of the height of the peak/groove to its width.) The polyester cover sheet is removed from the laminated disc. To center the stamper, a centering pin is first inserted into the disc center hole. The stamper is then concentrically fitted to the disc using the same pin. A sandwich is made by pressing the stamper onto the information layer with pressure rolls. The tackiness of the layer holds the stamper in place and the centering pin is removed. The sandwich is then placed between polycarbonate shims to protect the sandwich from the press platens. The sandwich is loaded at room temperature into a 70,000 lb. capacity hydraulic platen press with 12×12 inch die space, 5 inch diameter ram and manual lever action (Pasadena Hydraulics, Inc., Pasadena, Calif.). The load is quickly increased to 40,000 lb., corresponding to a pressure of 2,282 lb./in.<sup>2</sup> based on a 17.5 sq. in. sandwich area. The load is released after 15 seconds dwell time and the shimmed sandwich is removed from the press. The shims are then removed from the sandwich.

The embossed information layer is then firmly bonded to the substrate and the embossing made permanent by ultraviolet radiation exposure. The stamper-substrate sandwich, with the transparent substrate facing the light source, is placed approximately 50.8 cm (20 in.) from the source in a high intensity ultraviolet exposure unit (5 kill OLITE ® Printing Light, Model AL53-M, Olec Corp., Irvine, Calif.). After a 15-s exposure, the stamper is removed by flexing the assembly slightly. The embossed disc is conditioned for 2 minutes in an argon atmosphere and again exposed 15 seconds in the ultraviolet exposure unit. The embossed surface is inspected with a microscope. It is clear that stamper information has been transferred to the photopolymer layer with good fidelity.

The cured embossed disc contains all the required relief information to be used as the optical scanning element and is used successfully in a scanner system as disclosed in European Patent Application 86308641.9.

#### EXAMPLE 2

This example illustrates the preparation of a holographic optical element with an air-gap protective cover.

A disc holographic optical element for use in a scanner system is prepared as described in Example 1. To the cured embossed surface of the disc 0.25 inch wide, adhesive, annular spacers are applied to the inner and outer edges of the disc. An identical, second, poly(methyl methacrylate) disc substrate is then applied in register to the annular adhesive spacers to form an air-gap between the embossed optical element and the sealed protective layer.

I claim:

1. A method for replicating an optical element having a surface relief hologram comprising the sequential steps of:

(a) laminating a dry photohardenable film to a surface of a dimensionally stable optically transparent substrate, the film capable of being embossed at room temperature to form a relief holographic image having an aspect ratio of at least 10:1;

(b) embossing a relief holographic image in the photohardenable film at room temperature by applying thereto under pressure a stamper containing a reverse relief image of the hologram having an aspect ratio of at least 10:1;

(c) passing actinic radiation through the transparent substrate and the unheated photohardenable film to effect hardening of the photohardenable film while maintaining embedded contact between the stamper and the photohardenable film; and

(d) separating the stamper from the photohardened film containing the surface relief hologram having an aspect ratio of at least 10:1.

2. The method of claim 1 in which a polymeric protective layer is applied to the surface of the embossed photohardened film subsequent to the embossing step.

3. The method of claim 1 in which the substrate is formed into a disc prior to lamination.

4. The method of claim 1 in which the substrate is in sheet form prior to lamination and is formed into a disc following lamination.

5. The method of claim 1 in which the substrate is made from a material selected from the group consisting of polycarbonate, poly(methylmethacrylate) or glass.

6. The method of claim 1 in which the photohardenable film has a creep viscosity of at least 20 megapoise.

7. The method of claim 1 in which the stamper is made by the sequential steps of:

(e) applying a second dry photohardenable film to a surface of a dimensionally stable substrate;

(f) embossing the exposed surface of the second photohardenable film with the surface of a relief hologram;

(g) passing actinic radiation through the second photohardenable film to effect hardening of the second photohardenable film while it is in contact with the stamper; and

(h) separating the photohardened film from the relief hologram.

8. The method of claim 7 in which a release layer is applied to the second photohardened film after step (h).